

tion. How few things are demonstrated! The proofs only convince the mind; custom renders our proofs more strong. *It inclines the sense, which draws the spirit with it unconsciously.*

"It is necessary to acquire a more ready faith, which is that of habit; which, without violence, without art, without argument, makes us to believe the facts, and to devote all our powers to that belief, in such a manner as our mind *naturally takes.*"

We have only a word to add. If habit has such a powerful action on acts purely intellectual, it without a doubt has an incontestable influence on the phenomena in which intelligence less constantly intervenes, such as those of the vocal acts; and this is the point we have endeavored to prove in this memoir.

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#### IV.—SOME REMARKS ON THE THEORY OF INHIBITORY OR REFLEX PARALYSIS.

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*From the Practitioner.*

IN the *British Medical Journal*, 1874, I., p. 40, the following passage occurs in a highly interesting lecture on diabetes, by Dr. L. Brunton: "The second way in which the hepatic vessels may be dilated is by reflex paralysis, or inhibition, as it is generally termed, of their vaso-motor nerves. Every one knows that when a sensory nerve is irritated, the impression is transmitted to the vaso-motor centre, and arrests its usual action over the vessels of the part to which the sensory nerve is distributed. Thus, when a grain of sand falls into the eye, the irritation which it occasions to the sensory nerves of the conjunctiva is conveyed by them to the vaso-motor centre, and arrests the action of that part of it which

regulates the contraction of the conjunctival vessels. In consequence of this, they become dilated and full of blood, and continue so while the irritation continues; but so soon as it is removed the vaso-motor centre again regains its wonted power, and the vessels return to their normal size. The same is the case with the liver, and its sensory nerve is the pneumogastric." Loven's experiment on the auricular nerve of the rabbit, Rutherford's demonstration of the inhibitory action of the vagi on the gastric blood-vessels, Bernard's of that of the gustatory nerve on the vessel of the submaxillary gland, and Cyon's of the action of the depressor nerve of the heart on the intestinal arteries, through the splanchnics, constitute, I suppose, the chief experimental evidence in favor of the view above stated, which now seems to be reckoned among the accepted doctrines of physiology. As Dr. Brunton takes his illustration of the mechanism of the process from pathology, it may be concluded that he considers the same view to be applicable to morbid as well as to normal actions.

Admitting this, it may, however, be well to point out in what respects pathological differ from physiological inhibitory actions: 1. The immediate motors of the former are not normal and appropriate stimuli, but injurious irritants, or depressants. 2. The paralyses are not confined to vaso-motor nerves, but affect also musculo-motor, common and special sensory, and even the hemispheres themselves. 3. The districts affected are often non-coterminous with, perhaps remote from, that occupied by the incident nerve and its ramifications. 4. The occurrence of pathological inhibition may depend not on an absolutely excessive or injurious irritation having been applied, but on the incident nerve, or the recipient centre, being previously in a morbid state, hyperæsthetic, or hyperexcitable. 5. The same irritation may affect (pathologically) different parts in different persons. 6. Physiological inhibition is essentially transitory; pathological continues as long as the irritation persists. 7. Physiological inhibition is requisite for the performance of some function; pathological conditionates disease, disorder of function.

Sufficient heed has not always been given to the difference which may exist between the effect of different kinds of excit-

ants. Just as we know it is with mental influences, some of which exalt and intensify nerve-force, to a high degree, while others as powerfully depress it, so it is, probably, with physical. One which is appropriate in kind and degree may be a very beneficial stimulant; another which is too powerful or altogether pernicious will have the most opposite effect. Thus it certainly is with wine and electricity: both in suitable doses are recreative; both in excessive, are ruinous to healthy life. A carious tooth and a warm condiment are, no doubt, both excitants of the same sensory nerve; but how very different are the impressions made on the nerve centre in the two cases! All impressions on sensory nerves certainly do not paralyze the associated vaso-motor. Vasa nerve centres appear to be more readily paralyzed than any other; which may depend partly on their being smaller, and therefore more easily deranged than larger. It may also be the case that the resulting hyperæmia is more easily appreciated than diminutions in the force of muscular masses, or in the tactile faculty of the integument. Some morbid phenomena of inhibition produced by disease are almost as precise and significant as the results of experimentation. It may be well to enumerate a few for the sake of those to whom the idea is not familiar:

1. Crimson flushing of head, face, and neck, from gastric irritation, itself perhaps depending on gastric hyperæsthesia, unilateral flushing and heat, sweating of face from loaded bowels, face hyperæmic, and covered with sweat when prepuce was irritated in a case of preputial neuroma. (*Vide* Verneuil, *Year-Book Syd. Soc.*, 1862, p. 239.)

2. Salivary flux from uterine irritation in pregnancy, or from neuralgia of fifth, or from irritation of filaments of the vagi distributed to the œsophagus. (*Vide* Dr. Fussell's case in *Lancet*, 1873, II., p. 625.)

3. Paralysis of heart by gastric, intestinal, cutaneous, or urethral irritation, as in gastralgia, peritonitis, burns, and operations on the urethra.

4. Paralysis of vasa nerve centres from stricture-splitting, with coma; temperature  $107^{\circ}\cdot6$ . (*Vide* *Medical Times and Gazette*, 1873, II., p. 121.)

5. Sensory paralysis, as in Roche's case (*vide* Brown-Se-

quard's Phys. of Central Nervous System, p. 131), and Sir Thomas Watson's case (Lectures, last edition, Vol. I., p. 538.)

6. Motor paralysis, *vide* instances of reflex paraplegia given by Brown-Sequard; a case, cited from Mr. Morgan, of stone in bladder *vide F. N. D.*, p. 140; a case of my own, at p. 115, of left hemiplegia cured by an emetic; case of same ceasing after delivery, *vide* p. 119; cases of palsy from exposure to cold; cases of paralysis of muscles of eye, in neuralgia of fifth.

7. Cases of amaurosis from gastric or dental irritation.

Those who hold with me that pain is a mode of sensory paralysis, will see in the common instances of reflex, or remote pain, a phenomenon closely analogous to, if not identical with, inhibitory paralysis.

The first observer who entertained the idea of reflex paralysis of blood-vessels was, I believe, Henle, who proposed a theory to this effect: That the nerves of the vessels are in antagonism with the nerves of animal life, especially with the centripetal, so that in proportion as the latter are excited, excitement ceases in the former.\* This view was adopted by Mr. Simon in his admirable lectures on pathology, where he says (p. 80) that "reflex relaxation" (as he calls it) appears to him "the only plausible explanation of the condition of the larger blood-vessels in active hyperæmia, whether inflammatory or hypertrophic." Subsequently, the views developed by Weber, Pflueger, Rosenthal, and Nasse, as to the existence of certain systems of inhibitory nerves, contributed to familiarize the minds of inquirers with the idea that one nerve might diminish the action of another. Lister's researches confirmed and corrected these views, showing that the same afferent nerve might enhance or inhibit, exalt or depress, the functions of the nervous centre on which it acts, according as the stimulus applied to it was mild or potent. His paper was published in 1858. Bernard's essay on the influence of paralyzing reflex agencies is dated September, 1864; Loven's paper appeared in 1867; Rutherford's in 1870. My views were first published in February, 1859, in the *British Medical*

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\* *Traité d'Anat.*, Vol. II., p. 58.

*Journal*, and subsequently developed more completely in my Lumleian Lectures, *Medical Times and Gazette*, 1865, and in *F. N. D.*, 1864 and 1870. They have been well appreciated by Anstie, but are scarcely mentioned by anyone else. Brown-Sequard, in his lectures published in the *Lancet*, 1860 and 1861, laid great stress on the production of paralysis, either in the cord or in the brain, by remote irritation; ascribing it, however, rather to anæmiating spasm of the vessels of the paralyzed centre than to a direct action of the afferent nerve on the nerve cells. Though I differ from him on this point, I think he has contributed very highly, perhaps more than anyone else, to establish the doctrine of reflex or inhibitory paralysis. His extension of this view to those cases where head symptoms—paralysis, etc.—cannot be explained by any discoverable destruction of the organ of the will, or of the conductors between it and the muscles, seems to me quite correct, and a step of no mean importance. Henle's original view, important and suggestive though it be, and supported by Loven's experiment, does not seem to be substantiated. All excitements of afferent nerves do not dilate blood-vessels. Cold operating reflexly certainly does not. Nor does heat invariably, for Trousseau found hot water a more efficient styptic in epistaxis. Neuralgic perturbation does not induce hyperæmia in the majority of cases. Local irritants generally confine the resultant hyperæmia to the area on which they act, and produce no general flushing of the adjacent surface. Their action seems to be rather on the tissue than on the vessels. When the skin on being scratched with the fingernail presents the *tache meningitique*, it is difficult to think that the lines of redness can be produced by any paresis of vaso-motor nerves. If such occurred in a reflex manner, it surely could not be so limited in extent, but would appear as a more or less wide-spread flush, as in instances cited in my Lumleian lectures. In five instances where I faradized the peroneal nerve with moist rheophores, just below the head of the fibula, for five minutes, no redness of the skin of the parts below was produced, and only in two or three some filling of one or two superficial veins. Galvanization is known to be much more effective than faradization in causing augmented blood-flow in the district traversed by the current.

On the whole, it appears, I think, that my original view is correct ; that it is for the most part *morbid* excitation—*irritation* as opposed to *stimulation*—which produces reflex or inhibitory paralysis in any part. Some few instances there are of physiological inhibition, but these seem only to render it more probable that a similar effect can be produced pathologically. Loven's experiment, on which much stress is laid, seems to me rather an instance of pathological than of physiological inhibition. If we think what a difference there must be between our rude experimental excitation of a nerve and the normal, we must admit that the conclusion arrived at by Mr. Lister, respecting the different effects of gentle and strong stimulation, is highly rational and probable.

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ART. V. — NOTES OF SOME RECENT CASES OF  
DEAFNESS, FOLLOWING CEREBRO-SPINAL MEN-  
INGITIS.

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THAT many cases of deafness, following cerebro-spinal meningitis, give evidence that the lesion is in the perceptive apparatus of the ear, instead of in the conducting, is well known. It is, however, often difficult to ascertain, in these cases, the extent of the lesion and its exact location ; to determine if it be in the brain, at the origin of the auditory nerve, in the length of the nerve, or in its termination.

The ordinary tuning-fork of musicians will generally afford a means of deciding whether the conducting or perceptive apparatus alone be affected ; but where both are involved, diagnosis is more difficult. Since nervous deafness is a far more serious calamity than impaired hearing, dependent upon some